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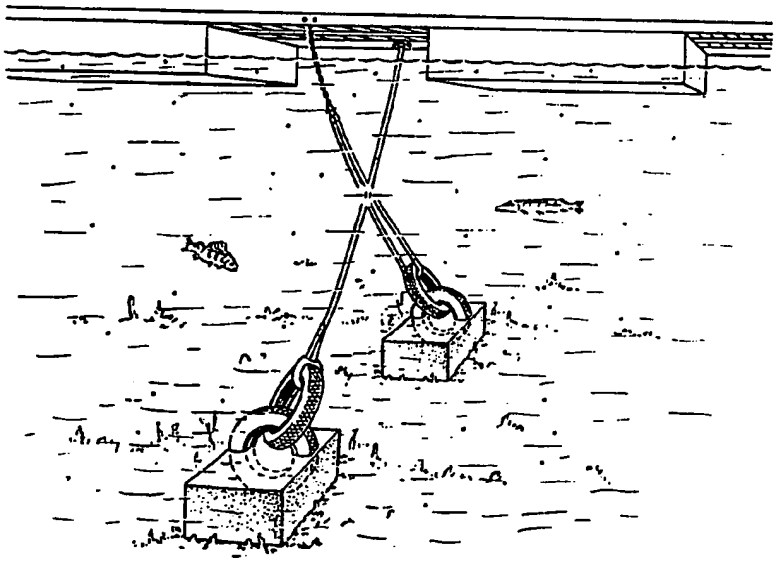
(57) Abstract



System for permanent mooring of a floating object, for instance floating-bridges, pontoons, buoys, boats and so on. The most principal newness is the following: that rubber skeletons are used to serve as simple loops and that several can be linked together as well internally as externally and which can serve as protection for wear and tear and elastic connections and be used too as entering skeletons into ring-anchors cast in concrete, that ropes in material, made out of artificial fibres, are used as wowen belts. A permanent mooring in standard version is performed in the system so that a rubber belt - for motorcycles, cars or contractmachinery has been cast into the anchor on the bottom as a fastening loop, unchangeable for age and somewhat elastic (1), that in this first rubber tyre (1), thereafter as a working chain-link one quite another rubber tyre (3) has been thread into it which gives a furthermore elastic connection from the anchor to the mooring-link-length through the water up to the floating object, hereby moored, on the surface. This (3) takes all well the wear and tear around the anchor and in that way gives open water around the connection (6) to the mooring goods which then offers the possibility of using artificial material, unaffected by water, both unchangeable of age and to a lower price. By the fact that the improvements occur through simultaneous simplicity the invention gives a consumption of energy and cost for production, min 70 % lower. Furthermore everything runs faster and easier to transport, lay out and to maintain than what it should be with the chain-moorings used today.

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SYSTEM FOR PERMANENT MOORINGS AND MARINE ANCHORINGS.

This invention relates to a system for permanent moorings of buoyant objects for instance floating-bridges,pontoons, buoys and boats and consists of broadly speaking 1.one joint-length trough the water between 2.one special anchor and 3. the connection to the moored buoyant object.The mooring forms a marine anchoring.

Here on shore we know exactly how to fasten and safely anchor different objects to the best possible use.The word f-ö-r-t-ö-j-n-i-n-g is the corresponding nautical term in Swedish.The wordcombination here gives us what we want now:this shall be fixed but at the same time extensible.It is very easy to imagine what will happen if we try to fix a floating body to one single entirely stiff anchoring.If the weight of the anchor on the bottom is equal with or less than the floating power which,according to Archimedes Principle,effects the body,this will grow lighter instead and follows the movements of the body at level-changes of the surface of the water or waves on this.A stiff anchoring from a floating body to an anchor which weights more than the floating power which affects the body,brings this down in the wave-motions and so on.Therefore the moorings and marine anchorings in function have to be elastic or springloaded in some ways.We will immediately get a fretting effect,on the other hand compared with that in the water not usuable quite stiff anchoring because of the friction on the movable points of the mooring.

At the beginning of the 19th century the flexible hardy chain -"iron-ropes"-replaced the stiff hemp-ropes as mooring-goods to the bow-anchors of the steam-ships and are still beeing used in shipping today.One length is laid,considerably longer than the depth of the water in question 3-5 times this.Because of the self-weight of the chain-cable this will hang in a parabola curve from the anchor on the bottom to the ship on the surface.By means of this the desired spring-loading effect is automaticly obtained.The tug-load on the anchor comes towards te bottom diagonally at an angle which increase the effect on the anchoring.Furthermore the principle at stake is that the less angle there is between the straight line distance from the ship on the surface to the anchor on the bottom,its

wave-motions have the less effects on the joint-length according to the sine-function with perpendicular depth of the water as the one cathetus and the distance from there out to the anchor as the other cathetus.**This works so satisfactorily well that the same model for permanent anchorings is still being used quite simply.**The ship anchor is exchanged with a natural stone with a loop of steel,drilled into it,or a cast concrete stone.But on the other hand more wearing points are recieved at the same time from the loop in the middle(see Fig.3).The anchor is dropped at a good distance from the pontoon The spring effect can be raised by hanging more weights on the parabola curve at permanent anchorings.This is neccessary in shallow water where the length of the chain is shorter and then with a comparatively lower self-weight,even to reduce the swing-extent at narrow places.The maximum load of the anchor occurs when the joint-length is stretched for instance by hard winds and the floating-object gets,at the same time in its own wave-moment,in phase with the lifting power of the wave.While the ship has weighed anchor and continues her way,the permanent mooring of the pontoon for example is made once for all.But the chain length corrode always in water.Iron is a metal which oxidizes easily.Ever since more than hundred yers warmgalavanizing is still the best surface-coating to preserve the iron.On land in usual air-milieu this will last very well and for a long time.In water,on the other hand,an electrical current arises immediately in the steel material with water as elektrolyte.This electric-chemical reaction affects the steel which converts from its solid form into porouse decay on the oxidation.First of all the galvanic surface destroys by corrosion,as some local elements arise on the surface in the electrolytic milieu where zink lies lower on the tension chain between different metals.As long as zink remains,the iron is preserved in the electrochemical process.At the same moment as the galvanic chain-cable gets into the water this attack,however,has already begun and when the zink is consumed,the iron continues to oxidize.Salter water gives stronger electrolyte and faster reaction with a shorter time of durability as a consequense.The combination between different

metal materials gives separate small galvanic elements where the one which lies lower on the tension chain,will oxidize faster"One chain-length is never stronger than the weakest link".The vegetation too,in the envirement and on the object which begins rapidly in the water,seems to strengthen the electrolyte in the envirement of the chain-cable and thereby accelerates the corrosion.From the above mentioned the same thing is applicable to the steel-loop which forms the chain-hold in the anchor stone.A downgraduating of the material of more than 20% enforces a change of the whole length of the chain.An exactly great downgraduating of the anchorloop enforces a change of the whole anchor,too.A thickness of the goods of 1/2 inches lasts for 5 to 6 yers in our water here in Baltic Sea and needs to be inspected after the principle,the more often,the safer.To be able to remove these inconveniences and expensive draw-backs with the anchorings of today,a system of marine anchoring has been developed where the ideas of the most important one which are stated in the patent-claims, have been combined with commen solutions to a practically functioning invention.

The external premisses for marine anchorings for bridges,boats and so on are different for every place.The sea-bottom plain or sloping,can consist of everything from soft slime to bedrock. The position in the water may be a sheltered creek or directly on a navigable passage.Marine anchored floating objects are affected by winds,water-streams,waves and the reflections of the waves.Different big floating objects demand of course differently dimensioned anchorings.One type is used for a bridge fixed to several anchorings,another kind is demanded for a simple swinging buoy.Different needs,especially to be able to control the sub-marine part,occurs of course.The performance of the anchoring is varying,and is specially adapted to the conditions,as these presumptions,the kind of anchoring and special demands change.The material in the three elements, according to the above mentioned,the joint-length,the anchor and the connection to the moored floating object,is carefully chosen and adapted to manage the special marine milieue.The anchoring system as a whole succeeds in combining satisfactorly

these technical demands and this adapted material quality to the demands of the bridge-owner and of the skipper on good economy at the lowest possible cost,for instance by re-using material discharged from its primary adapted sphere of use and as otherwise making a growing waste problem too.This new mooring system is described as a simple standard outcarrying adapted to generally existing circumstances out in the Stockholm archipelago.The performance which is then adapted to suit the anchoring according to soft bottom.shallow water,water with many movements and so on,can be varied in the most suitable way as well as spec.details for extra fretting protection and so on,and are only limited by the patent-claims.

Reference to the enclosed drawings hereby.

Fig.1:Survey.Two permanent anchorings of a floating-bridge according to the invention seen from the bottom.One of them to a bridge-hold as a lashing-winsch.The other one with a course chain as a connection.

Fig.2.Detail.The special anchor here even with a smaller anchor connected as an extra jerk-moderator.

Fig.3.Illustration.How the big fastening-loop and the other rubber loop connected into it bringsout the mooring-goods from the frettingpoints of the anchor-stone.

According to the above the first one of the three principal parts is the joint-length between the anchor and the anchoring-object on the surface.The thick hemp-ropes of the olden times sucked in water and rottned.The heavy but flexible chain corrodes.The cordage of synthetic material replaces now.We get tug-tenable goods when the yarn in the strands of the rope is built up by long fibres.As the long natural fibres(hemp, manilla and so on) are of course limited,the synthetic fibres can be made as long as one likes,in the type of silk.The cordages in synthetics becomes more than twice as strong and can be chosen with weight and dimensions correspondingly smaller The intake of humidity is unchanged in the water.An extra water dismissal can easily be obtained by water-proofing methods Whereas the hempropes have to be tarrèd,the synthetic fibre remains inaffected of water.Living organisms do not attack.We do not get any rot nor mould.As for a comparision with the

chain of the same tug-tenacity really the quality ought to be non-corrosive for the equivalent time of durability.But if you take the considerably cheeper galvanized one,the metre-price of synthetic goods lies about 60% lower.However you have to be very careful with the laying-out,so that the soft mooring material is hanging quite by itself in the water.Worked out as woven belts the use of the mooring-goods is facilitated.A belt of the same tug-tenacity as a chain of a half inch need not be broader than 50 mm.We recognize the belts from our safety belts in cars,cargo-lashing and so on.The belts are sewn according to the formula:the number of stitches/cm x x the length of the seam x the number of seams x the tenacity of the thread x 0,85(the loss factor) with the seams always at an angle towards the warp threads in a plain or double sling.The double sling makes it possible for control and an eventually exchange of the belt from the level of the surface, too by pulling this around all as.The belts are protected from wear and tear on their most exposed places at the passages up and down with cast plastic material,fagstockings which are sewn on or something of the like.

The second one of the three principal parts consists of the anchor.In the standard version this is composed by a concrete stone(Fig.2).In this there is a skeleton of a tyre,for instance a quite usual car-tyre,but no longer fit for traffic,and moulded by one half in order to function as a big anchor-loop here.The two edge-yarn-rings of the tyre turns into two even wire-loops,carefully fixed into the concrete.These are elasticly kept together with the cord material,steel girdle everything inside the outer wearrubber which after the vulcanizing production of the tyre always labours at giving back its round form to this.In an ordinary 15 inch tyre every edge-thread-ring consists of about 15 one mm threads inside the rubber.Each of the two edge-thread-rings has therefore a goods-thickness of a corresponding 1/2 inch chain for instance.This har normally a tug-tenacity of about 5 tons.Performed tug-tests with a dynamometer confirm that the tyre holds for more than this in spite of the tyre being such one which has been dismissed for further road traffic.Before the casting into the anchor

the tyre is opened at one place and this cut(5) is then cast into the bottom.Through this cut(5) has also before the casting a similar but intouched withuot cut second tyre(3) been set in.This second connected rubber tyre,with its special outer tearing surface,takes up existing mechanical wear and tear against the anchor-stone and offers open water to the continued joint-length(Fig.3).Alltogether the rubber tyres makes an elastic connection to the anchor-weight which fulfils the desire of jerk-moderation.The innerdiameter of a 15 inch tyre is 37,5 cm and can be stretched up to 20 cm.The diagonal cord-cloth makes the elasticity more inert than radial cord-cloth.In order to protect the faying-surfaces between the two internally linked tyres(1 a 3),before the casting into each of these,there has also been brought into position a somewhat smaller tyre for instance a 13 inch into one 15 inch,so called wearing-tyre(2 a 4).The only task of this is to take the wearing at the faying surfaces and entirely protect the outer tyres(1a3) which stand up for the tug-tenacity.The wearing-tyres(2a4) also distribute the powerattacks on their respective outside tyres(1 a 3) at tug-touches.The friction on the faying-surfaces are diminished,too,by the fact that the self-weights of the tyres have diminished on the bottom and the water con be considered to grease a little.The concrete anchors are always cast rektangularly with regard to measures of the cast tyres(1) of the least possible breadth.We remember the early anchors with a few cm:s steel-loop in the middle and the wearing of the mooring-goods after the anchor-stone and its edge.Now our steel-rubber anchor-loop is much bigger and the stone as narrow as possible to be able to get the mooring-goods out as far as possible(Fig.3).When claims are taken on heavy anchors two or several smaller tyres can be used parallelly as a fixing-loop in the anchor and there into linked mooring-tyres as an alternative to one single big tyre.The connection between the belt and mooring tyre(3) occurs by an U-formed hose,just as well oval and adapted to the breadth of the belt(6) The hose(6) shall be fixed around the tyre so that its internal legs are extended and laid crosswise for riveting together or tied up with a small thin belt around through the hose.

In the hose(6) the belt runs through the mooring-tyre(3) at the least possible friktion.In shallow water and water with big wave-motions extra tug-moderation are desired.Then a second considerably smaller anchor is cast too,whose fixing-loop has been connected together with the second tyre of the first anchor,and the mooring-goods are moved from the second tyre of the principal anchor to the second tyre of this smaller anchor,which is threaded in the same way as the second tyre of the principal anchor(Fig.2).An alternative tug-moderation can be made in this system so that several skeleton-tyres are laid after each others and are linked together with the wearing-surfaces against each others by for instance a non-corrosive flat metal sheet,which is formed crosswise around the tyres at each faying point and they are welded,riveted or boltjointed there to a hereby arisen straight chain of external rubber-tyres,linked together which serves as an extra tug-moderating elastic length,installed into the mooring.

At last in this standard performance here described the conection to the moored floating object is composed of one 1-2 metres long chain-cable from the bridge-hold,the buoy etc.Herewith it is meant to spare the belt from possible icefrettings which we have here in winter-time and from other wear and tear,too, which may occur around the bridge-deck.If the chain-stump is chosen of a much courser dimension than that the tug-tenacity of itself demands,in spite of the corrosion graduation downwards this can receive a time of validity of the 15 years which the anchorings are indeed at least of all expected to hold.As the belts are lacking self-weight in the water,this metre length chain works as a weighing-adjustment of the buoy in the water.Independent of the depth of the water an identical size of the buoy-float can be kept.In mooring performance with chains all the way down a still bigger buoy has to be used at increasing water-depth.Especially in buoy-anchorings where the light buoy heels and swings in the sea the whole time,the chainstump moderates directly throughout,these motions and reduces thereby the frictions on the hold of the belt in the lowest link under the water.This hold is especially forged as a simple triangle,a schackel or something similar,of

a sufficial breadth for just the belt which is here used.The belt moves mostly in this point and is protected against wear and tear at need.Especially in bridge-anchorings the chain-connection can be omitted and instead fasten the mooring-belt down from the anchor on the bottom to a hold in the bridge, formed especially for this as a small lashing winsch.This will facilitate the adjusting of the belt-length on differences of the water-level.The belt rulled up on to the winsch-coil,has eliminated the friction-wearings in the upper connection(Fig.1). According to the new system,described above,all the laying-outs shall be carried out only in the presence of a diver.The work shall be carefully controlled so that the mooring-belt hangs by itself in the water and so that the wearin guards of the upper and the lowest connections are correct.After such procedure the mooring is expected to keep for 15 years or more.All troublesome inspections of the chain-anchorings with always hesitative decisions when the corroding chain-steel shall be exchanged,will vanish.at the same time,too,the great cost of material and labour which are involved in evrey exchange.The differences between the chain-performance and the new system of anchorings will increase progressively with the depths of the water.Furthermore to the whole picture of this new system the fact is that you,by producing one single chain-anchoring for instance at a depth of the water of 10 metres,can produce 10 corresponding pieces in the new system at the same cost and energy contribution.The quality of the system lies in the fact that the external existing conditions where the given technical solutions offer the possibility of using material which has free cost maintance in the special marine milieu and at the same time within easy reach on the market,to one part even regained from the surplus production.

Improvement through simplicity!

PATENT-CLAIMS.

1. System for permanent mooring of floating objects,for instance floating-bridges,pontoons,buoys,boots and so on which mooring consists of an anchor in shape of a cast stone,a ringanchor something similar
c h a r a c t e r i z e d of
that one or several parallel rubber tyres,preferably a tyre of a car or something similar,are fit in on the anchor as an fastening-loop and
that one part,working as a chain-link,suitably shaped by one or several other tyres(3),is fit into the rubber-tyre working as a fastening-loop(1) and
that some mooring goods of artificial fibre material are fit in between the second rubber-tyre(3) and the floating-object.

2. Mooring according to the paten-claim 1
c h a r a c e r i z e d of
that the first rubber-tyre or the first rubber-tyres(1) are cast into the anchor,to one part suitably to the half, and inside this(1) one tyre,some inches smaller,has been laid(2) and even its lower part is cast into the concrete.

3. Mooring according to the paten-claim 2
c h a r e c e r i z e d of
that the first rubber-tyre or the first rubber-tyres(1) together with their smaller tyres laid into them(2) have been furnished with one whole cut(5) right across the tyres to facilitate the onthreading of this or these second rubber-tyres working as a chain-link(3) on the first rubber-tyre or the first rubber-tyres(1)
that this cut(5) is one part of the first rubber-tyre or the first rubber-tyres(1),which is cast into the anchor and lies further down.

4.Mooring according to the patent-claim 3
c h a r e c t e r i z e d of
that even the second tyre(3) which is linked into the first one(1) internally has a tyre,correspondingly some inches smalleer laid into it.

5.Mooring according to the patent-claim 1
c h a r e c t e r i z e d of
that several rubber-tyres are laid after each other and are so linked together with the wearing-surfaces towards each other,by for instance a non-corroding flat tin-plate which is shaped straight across the tyres at each close-lying point and is weld-,riveted or bolt-jointed there to an straight chain,hereby arosen,and made up by tyres out-wardly linked together which put into the mooring,serves as an extra tug-moderating elastic length.

AMENDED CLAIMS
[received by the International Bureau
on 13 August 1990 (13.08.90);
original claims 1-5 replaced by amended claims 1-5 (2 pages)]

1. Mooring of floating objects,for instance floating bridges,pontoons,buoys,boats and so on which mooring includes an anchor in shape of a cast stone,a ringanchor or something similar
c h a r a c t e r i z e d in
that at least one or parallelly arranged tyres(1),preferably a tyre of a car or something similar serves as an fastening-loop on the anchor,
that one part working as a chain-link preferably shaped by one or several other tyres(3) is fit into the tyre(1) working as a fastening-loop and
that mooring-goods of preferably artificial fibre material are fit in between the second tyre(3) and the floating object.

2. Mooring according to claim 1
c h a r a c t e r i z e d in
that the tyre(1) serving as a fastening-loop is cast into the anchor to one part preferably to the half and
that inside this as a fastening-loop serving tyre(1) one somewhat smaller tyre(2) is arranged,a lower half of said tyre(2) is also cast into the anchor.

3. Mooring according to claim 1 or 2
c h a r a c e r i z e d in
that the tyre(1) serving as a fastening-loop together with the smaller tyre(2) into have been provided with a whole cut(5) right across the tyres(1,2) to facilitate onthreading of that as a chain-link working second tyre(3) and
that said cut(5) lies further down in said tyre(1),cast into the anchor and serving as a fastening-loop.

4. Mooring according to claim 1 or 2
c h a r a c t e r i z e d in
that also the second tyre(3) which is linked into the first as a fastening-loop serving tyre(1) internally has a tyre correspondingly somewhat smaller(4) laid into it.

5.Mooring according to the claim 1
c h a r a c t e r i z e d in
that several tyres are arranged after each other and are linked together with the wearing-surfaces directed towards each other by aid of for instance a non-corroding flat tin-plate,which is shaped straight around the tyres at each close-lying point and is weld-,revited- or boltjointed there to a straight chain hereby formed and comprising tyres outwardly linked together,said chain included into the mooring serves as an extra tugmoderating elastic length.

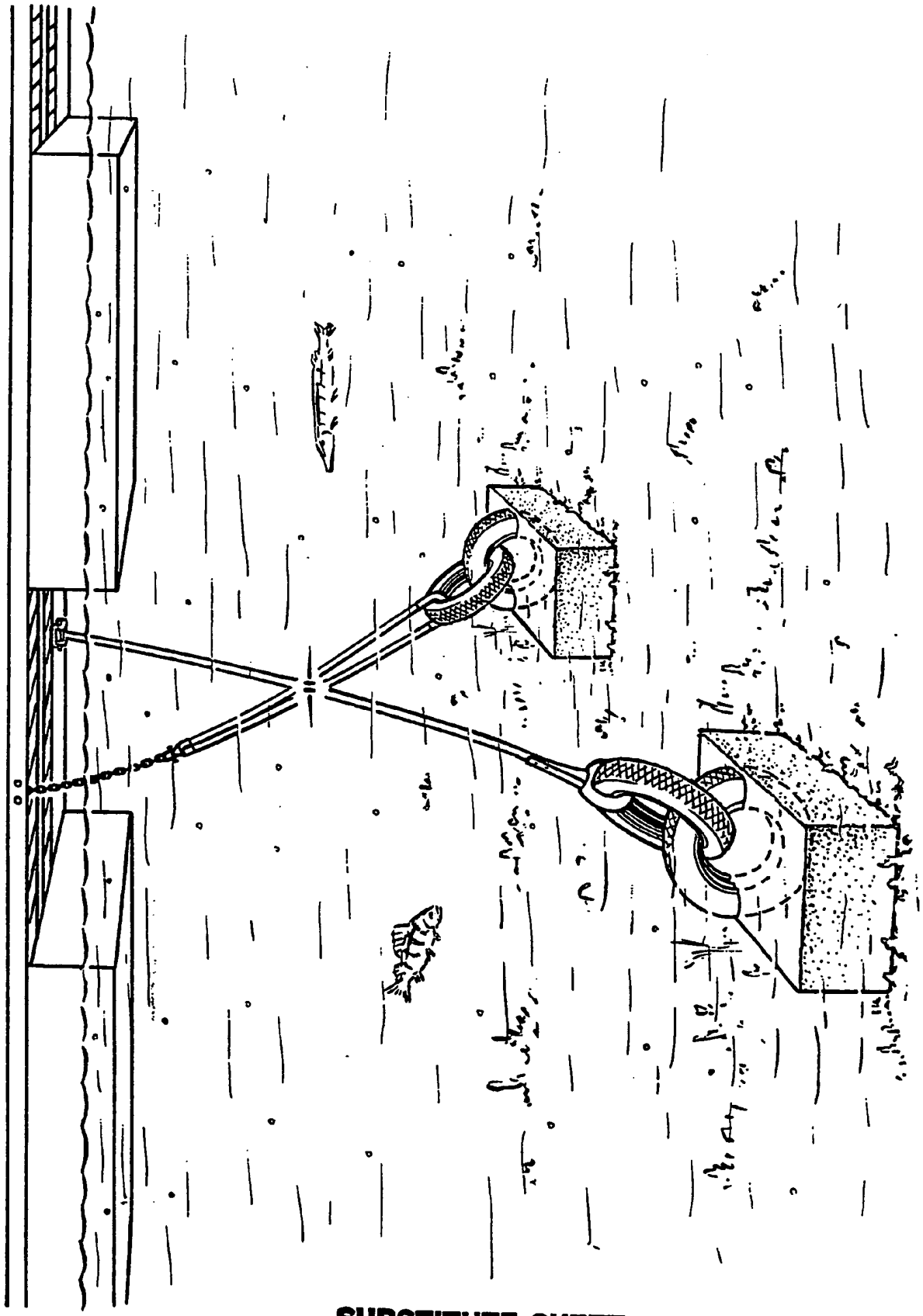

Fig. 1

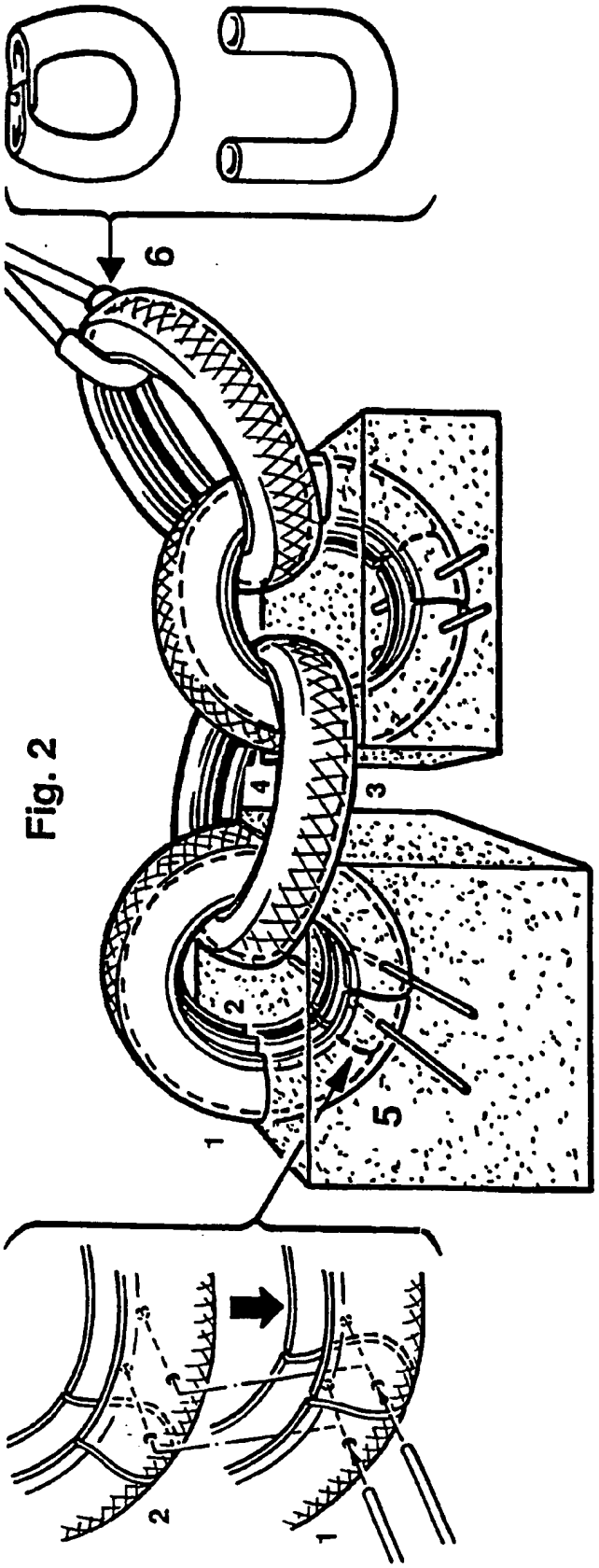

Fig. 2

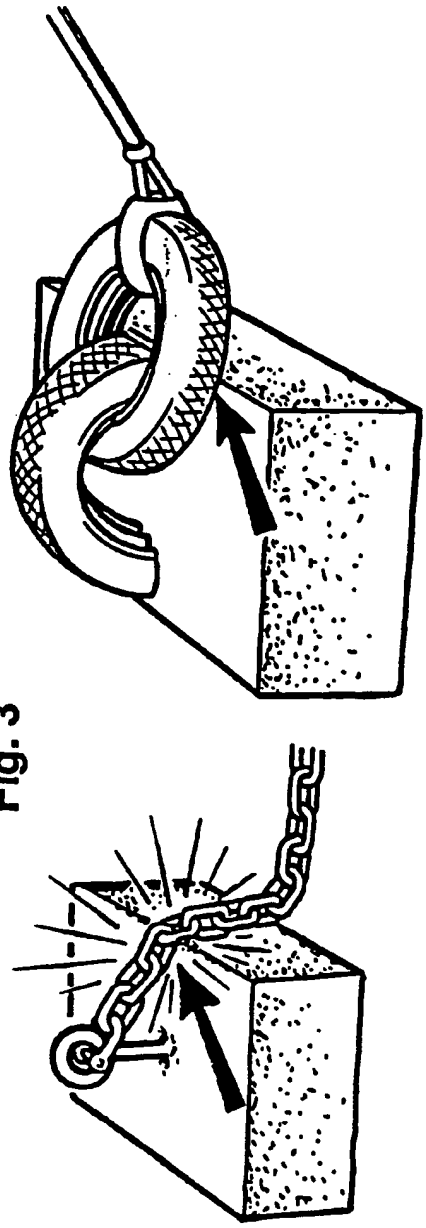

Fig. 3

INTERNATIONAL SEARCH REPORT

International Application No PCT/SE 90/00189

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)[6]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC5: B 63 B 22/04

II. FIELDS SEARCHED

Minimum Documentation Searched[7]

Classification System	Classification Symbols
IPC5	B 63 B

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in Fields Searched[8]

SE,DK,FI,NO classes as above

III. DOCUMENTS CONSIDERED TO BE RELEVANT[9]

Category *	Citation of Document,[11] with indication, where appropriate, of the relevant passages[12]	Relevant to Claim No.[13]
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IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
6th June 1990	1990 -06- 13
International Searching Authority	**Signature of Authorized Officer**
SWEDISH PATENT OFFICE	Christer Jönsson

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